

1. A method for estimating a voltage at a device in a power delivery network, the method comprising:
  - simulating operation of the device over a sequence of intervals;
  - determining an activity profile for the device from current drawn by the device in each of the intervals;
  - determining an impulse response for the power delivery network; and
  - filtering the activity profile with the impulse response of the power delivery network to provide a profile of the voltages at the device.
2. The method of claim 1, wherein the device is a processor and simulating operation of the device comprises simulating a response of the processor to a series of instructions over a sequence of clock intervals.
3. The method of claim 2, wherein determining an activity profile comprises summing active and idle currents of units of the processor on each of the clock intervals.
4. The method of claim 3, wherein the activity profile is a sequence of current pulses and filtering comprises convoluting the sequence of current pulses with the impulse response.
5. The method of claim 1, wherein determining an activity profile for the device comprises calculating a sequence of currents consumed by the device under simulated operation.

6. The method of claim 5, wherein the device is a processor and the sequence of currents is determined by summing active and idle currents for clock-gated units of the processor in response to instructions executed by the processor on a sequence of clock intervals.

7. The method of claim 1, further comprising determining a set of recursion coefficients from the impulse response.

8. The method of claim 7, wherein filtering comprises filtering the activity profile with the recursion coefficients determined from the impulse response to provide the profile of voltages at the device.

9. The method of claim 8, wherein the device is a processor and the activity profile is a sequence of current pulses determined by simulating operation of the processor in response to a series of instructions.

10. The method of claim 9, wherein determining the activity profile comprises summing active and inactive currents for one or more clock-gated devices of the processor on successive clock intervals.

11. A method for determining a voltage at a device in a power delivery network, the method comprising:

summing active and idle currents for units of the device on a sequence of intervals  
to provide a sequence of current pulses;

determining an impulse response for the power delivery network; and  
filtering the sequence of current pulses with a representation of the impulse  
response to estimate a voltage seen by the device.

12. The method of claim 11, wherein summing the active and idle currents comprises for  
each of the intervals:

determining which clock-gated units are active;  
adding a first value to a current pulse for the interval for the active clock-gated  
units; and  
adding a second value to the current pulse for the interval for the inactive clock-  
gated units.

13. The method of claim 11, further comprising determining a set of recursion coefficients  
for the impulse response.

14. The method of claim 13, wherein filtering comprises filtering the current pulses using the  
recursion coefficients.

15. A medium on which are stored instructions that may be executed by a machine to  
implement a method comprising:

determining an impulse response of a power delivery network to a current pulse  
having a specified amplitude, the impulse response being represented as  $1^{\text{st}}$  through  $n^{\text{th}}$

impulse response amplitudes, corresponding to 1<sup>st</sup> through n<sup>th</sup> time intervals relative to the current pulse;

simulating operation of a device to determine 1<sup>st</sup> through m<sup>th</sup> current pulses drawn by the device on m-successive time intervals, each current pulse being characterized by an amplitude and an offset interval;

for each current pulse, scaling the 1<sup>st</sup> through n<sup>th</sup> impulse response amplitudes by the amplitude of the current pulse and time-shifting the scaled 1<sup>st</sup> through n<sup>th</sup> impulse response amplitudes according to the offset interval to provide 1<sup>st</sup> through n<sup>th</sup> scaled impulse response amplitudes in (1 + offset)<sup>th</sup> through (n + offset)<sup>th</sup> intervals, respectively.

16. The medium of claim 15, further comprising adding the scaled impulse amplitudes in each of a set of intervals to provide an estimated device-voltage for each interval of the set.
17. The medium of claim 16, wherein determining an impulse response comprises:
  - determining a step response to a current step having the specified amplitude; and
  - determining the impulse response from the step response.
18. The medium of claim 17, wherein determining the impulse response from the step response comprises determining a first derivative of the impulse response in each of the 1<sup>st</sup> through n<sup>th</sup> intervals.
19. The medium of claim 15, wherein the device is a processor that operates responsive to a clock and the 1<sup>st</sup> through n<sup>th</sup> intervals correspond to 1<sup>st</sup> through n<sup>th</sup> clock cycles of the processor.

20. The medium of claim 19, wherein the processor is simulated as one or more units to which power delivery is controlled through an associated gate unit.

21. The medium of claim 20, wherein simulating operation of the processor to determine 1<sup>st</sup> through m<sup>th</sup> current pulses comprises:

identifying the units that are active in each of the 1<sup>st</sup> through m<sup>th</sup> time intervals;

and

in each time interval, summing currents drawn by the units that are active in the time interval.

22. A medium on which are stored instructions that may be executed by a machine to implement a method comprising:

determining a response of a power delivery network including a device to an electrical stimulus;

determining a set of recursion coefficients from the response.

simulating operation of a device over a sequence of intervals;

generating an activity profile of the device for the sequence of intervals;

filtering the activity profile with the set of recursion coefficients to estimate a voltage seen by the device.

23. The medium of claim 22, wherein the device is a processor including multiple execution units and generating an activity profile of the device comprises, for each interval:

determining the active and inactive execution units;

for each execution unit, adding a first or second value to a current amplitude for the interval, according to whether the execution unit is active or inactive;

representing the activity profile during the interval as the current amplitude.

24. The medium of claim 22, wherein determining a set of recursion coefficients for the response comprises fitting the response to an  $n^{\text{th}}$  order filter to determine the set of recursion coefficients.

25. The medium of claim 23, wherein the device is a processor and simulating operation of processor over a sequence of intervals comprises simulating execution of a series of instructions over the sequence of intervals.